

Albert Einstein—The Atom Bomb – I

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The release of atomic energy has not created a new problem. It has merely made more urgent the necessity of solving an existing one. One could say that it has affected us quantitatively not qualitatively. As long as there are sovereign nations possessing great power, war is inevitable. That is not an attempt to say when it will come, but only that it is sure to come. That was true before the atom bomb was made. What has been changed is the destructiveness of war.

—Albert Einstein, 1945¹

In the twentieth century, the secret was discovered for unleashing vast amount of energy, with the potential for causing great devastation. In 1908, Ernest Rutherford (1871-1937) received the Nobel Prize for his work on radioactivity, done at McGill University in Montreal, Canada. In 1911, he was the world's foremost atomic physicist and was working on a model of the structure of the atom with other outstanding researchers at England's Manchester University.² In 1919, as director of the prestigious Cavendish Laboratory at Cambridge University, Rutherford had the distinction of succeeding two great scientists, James Clerk Maxwell and Joseph John Thompson.³

Under Rutherford's leadership and through his collaboration with Niels Bohr, atomic physics advanced rapidly.⁴ Rutherford predicted that enormous amounts of energy would be released if an artificial disintegration of the atom were possible. As early as 1903, Rutherford had suggested in a 'Playful' way that with a proper detonator, 'a wave of atomic disintegration might be started through matter, which would indeed make this old world vanish in smoke'⁵ In 1919, Rutherford discovered something that at the time did not attract much attention: when atomic nuclei of helium and nitrogen

are made to collide violently, they change into hydrogen and oxygen nuclei.⁶ This fact seemed harmless but in reality led ultimately to the discovery of the neutron and the release of huge amounts of energy by the process of nuclear fission.

An alarming signal ends one chapter of work

In 1919, prior to his first trip to America, Einstein was to give a lecture at the university in Prague. To avoid being hounded by the press, he decided to stay the night with his friend Philipp Frank and his wife at Frank's physics laboratory office where the couple lived. Einstein delivered his lecture, after which a reception was given in his honour. An enterprising young man, tracking down Einstein to speak with him, had found out that he was staying with the Franks. The next morning, just as Einstein was about to leave the physics laboratory for the train to Vienna, the man approached him with great urgency. He was carrying a manuscript.

He told Einstein that, in effect, his famous equation, $E=mc^2$ pointed to the real possibility of developing a weapon of devastating power as soon as someone discovered how to release atomic energy. He asked him to help him accomplish this. 'It would be

possible to use the energy contained within the atom for the production of frightening explosives,' he told Einstein.⁷ Aroused by his conscience, Einstein immediately and decisively demanded: 'Calm yourself.' He further insisted, 'You haven't lost anything if I don't discuss your work with you in detail. Its foolishness is evident at first glance. You cannot learn any more from a longer discussion.'⁸ Another account of this incident reports Einstein as speaking much more adamantly: 'Get out! Don't argue with me. Don't try to tell me what can and what cannot be done! I tell you no one will ever use my formula to make an explosive. It cannot be done.'⁹ In a matter of such disastrous consequence for the future, Einstein abandoned his characteristically soft-spoken manner.

As a civilized man who despised militarism and longed for permanent world peace, Einstein felt that he must not carry his atomic studies further. He dreaded the idea of science being employed for destructive purposes. He gradually shifted his attention to matters involving politics, government, peace and the advancement of tolerance throughout the world.

Momentous verifications and persistent skepticism

In 1932, under Rutherford's directorship of the Cavendish Laboratory, a momentous event took place. That year, Einstein's famous equation $E=mc^2$, had been verified, exactly twenty-five years after he first put it forward. In 1933, additional research further confirmed Einstein's formula. While other scientists and scholars were leaving Germany with Hitler's rise to power, Enrico Fermi remained at the University of Rome in Fascist Italy. At the university, together with his team of scientists, he successfully bombarded uranium, causing the nuclei to split.¹⁰

Throughout this period, Einstein was skeptical about the ability to harness atomic energy. He simply did not believe it could be

done. Still, the promise inherent in his equation was an appetizing carrot that dangled before every atomic researcher. A number of times, Einstein was asked about the potential for releasing atomic power. During a visit to Pittsburgh in 1934, he answered this question by saying that '[s]plitting the atom by bombardment is like shooting at birds in the dark in a region where there are few birds.'¹¹

Up to a year before he died in 1937, Rutherford did not publicly express any belief that the energy bound within the atom could be released and used. In 1933, addressing a meeting of the British Association for the Advancement of Science, he had said, '[T]o those who look for sources of power in atomic transmutations—such expectations are the merest moonshine.'¹² Privately, he had doubts. In January 1936, in his Watt Anniversary Lecture in Scotland, he, however, spoke of 'new possibilities' in nuclear science through the discovery of the neutron.¹³ Rutherford concluded that although releasing and using the energy in the atom did not seem likely, he felt that he should warn others. He wrote to Lord Hankey, a high-ranking official in Britain's Committee of Imperial Defence, that 'the work of the Cavendish on nuclear transformation might one day have an important impact on defence and that someone should keep an eye on the matter.'¹⁴

Einstein shared Rutherford's skepticism. He was well aware that the best intentions of inventors and scientists are sometimes put to destructive use. In March 1936, Enrico Fermi's neutron bombardment was successfully repeated in Berlin at the Kaiser Wilhelm Institute by German chemists Otto Hahn (1879-1968) and Fritz Strassman (1902-1980) together with Austrian physicist Lise Meitner (1878-1968).¹⁵

1938: A pivotal year

In the early years of his regime, Hitler granted certain privileges to Jewish

scientists. However, by 1938 Hitler's fanaticism marked the Jews for total extinction. The Nazis circulated a book displaying photographs of enemies of the Nazi German State that included a photograph of Einstein, with the caption, 'Not Yet Hanged' beneath it. That March the Nazis occupied Austria. Lise Meitner, half Jewish, fled from Austria to Sweden. Learning of her impending arrest, she escaped by train to Holland, narrowly avoiding the Gestapo and certain death. In Holland, with the help of underground agents, she secured a Swedish visa and escaped to Stockholm, where as a foreigner she would be safe. Niels Bohr arranged for her to stay at the Nobel Institute.¹⁶ In 1943, Bohr, himself being half Jewish, fled Denmark to escape from the Nazis.¹⁷

Though Hahn and Strassmann had split the atom, they did not understand the far-reaching implications of their research. They sent the results of their experiments to Lise Meitner in Sweden, who repeated the experiment herself.¹⁸ In the words of writer Wilhelm Laurence, 'She was experiencing sensations that must have been akin to those of Columbus.'¹⁹ In 1938, she shared her history-making results with her nephew Otto Frisch (1904-1979), a scientist at Bohr's Institute for Theoretical Physics at the University of Copenhagen, while he was visiting her for Christmas.²⁰

'Aunt and nephew discussed Hahn's paper during a long walk in the snow-covered woods outside Stockholm, a walk that was to help shape the future of the human race.'²¹ Meitner and her nephew realized that the small amount of mass lost when the atom split turns into energy (nuclear fission).²² Meitner understood that nuclear fission, together with Einstein's mass-energy equation, represented the key to nuclear weaponry.²³ Meitner's nephew immediately informed Bohr, who was preparing to leave Europe to attend the Fifth Washington Conference on Theoretical Physics in America in the early

spring of 1939.²⁴ The military implications were obvious as the great nations of the world faced a life-and-death struggle for survival. Meitner's clarification of Otto Hahn's work eventually enabled the United States to build the bomb. And in 1945, Eleanor Roosevelt in a live NBC trans-Atlantic radio interview praised Dr Meitner's contribution and openly compared her to the illustrious Marie Curie.

Since 1938, events that would lead to the creation of the bomb had moved rapidly. In September, the major powers in Europe allowed the Sudetenland areas of Czechoslovakia to be taken over by Hitler's troops, in the hope of stopping Hitler's progress into other European democratic countries. In November, the Nazis waged war on the Jews in Germany. In December, Fermi (whose wife was Jewish) left Europe and went to America. Earlier, Szilárd had fled to America through England, where it had suddenly occurred to him that a nuclear chain reaction was actually possible—a flash of inspiration with grave consequences. Szilárd and Fermi obtained professorships at Columbia University and worked with other scientists to produce explosive nuclear chain reactions that would make the atomic bomb possible.²⁵

Alerting a free world

In 1938, Szilárd wanted to alert the American government that Germany had the potential to develop a nuclear weapon. Szilárd, not an influential man himself, decided to speak to Einstein about this danger. On 16 July, 1939, Szilárd and Eugene Wigner, also a Nazi refugee and professor of theoretical physics at Princeton University, set out to visit Einstein to discuss Szilárd's concerns.²⁶ Einstein was vacationing in a cottage he had rented from a Dr Moore in the village of Peconic on Nassau Point, Long Island. He had no idea the two were coming nor did he know the purpose of their

visit. Because they did not have his exact address, they had considerable difficulty finding Einstein. They asked many villagers to give them directions to Dr Moore's cottage, but no one appeared to know who Dr Moore was or where he lived. Just when they were about to give up out of sheer exhaustion, they gave it one more attempt. They asked a young boy if he knew where Professor Einstein lived. Like everybody else on the island, the boy knew that location and led them to his cottage on Old Grove Road.²⁷

Szilárd and Wigner informed Einstein that scientific research showed the real possibility of a nuclear chain reaction. Einstein immediately envisioned the scientific and political magnitude of this information. The three men then began to discuss a plan of action. Earlier, on 10 July, Szilárd and others had tried to negotiate with the U. S. Navy, but a naval spokesman had told Szilárd that the Navy had no interest in the development of nuclear weapons. Therefore, Szilárd felt that it would be useless to approach the U. S. government. He was also convinced that bureaucratic formalities or 'red tape' were potential obstructions.

Wigner knew of Einstein's friendship with the Queen of Belgium. They asked Einstein to use his influence with the Queen to prevent uranium ore from reaching Germany from the Congo—a colony of Belgium at the time—where the greatest resources of uranium existed. Unwilling to write to the Queen Mother, Einstein was prepared to write to someone he knew in the Belgian Cabinet. Szilárd and Wigner did not agree to his idea. Their next consideration was to correspond with a foreign government without the knowledge of the U. S. State Department. They reconsidered this last option and tentatively agreed that Einstein would write to the Belgian government, subject to the approval of the U. S. State Department. Events were escalating that would make their

mission terribly urgent. In March 1939, the Nazis invaded Czechoslovakia. On 1 September, the Nazis attacked Poland.²⁸

Earlier that year, other significant events had occurred in the scientific community. In late January 1939, Niels Bohr had arrived in America carrying with him knowledge of the military implications of Meitner's research. In February, Bohr and America's John Archibald Wheeler, Princeton University's famed theoretical physicist, had confidently predicted that a rare form of uranium atom could be split, making possible the construction of an operational bomb. They also indicated that a huge industrial complex would be required for this work.²⁹

Early in the spring of 1939, sometime around Einstein's sixtieth birthday, Bohr visited Princeton for two months.³⁰ He shared the news about fission—the successful splitting of the atom—with his colleagues there, who within hours of his talk, successfully replicated the experiment and verified the results. This verification led to more than one hundred published scientific papers on nuclear fission; one of these was the result of collaboration between Bohr and Wheeler. During Bohr's Princeton visit, Bohr and Einstein did not interact very much because the memory of their past debates about quantum mechanics was still strong.

Around the same time at Columbia University, Szilárd and his colleague Walter Zinn were giving the final shape to the report on their discovery 'that a controlled chain reaction was possible.' If the research were to continue, Columbia University would need outside funds. Szilárd was investigating every possible way to approach the President of the United States, as well as means for getting more funds for research. The search led Szilárd to Alexander Sachs, a very influential man in financial and political circles and a personal friend and advisor to President Roosevelt. Sachs suggested that the proposed letter be

addressed directly to the President and agreed to deliver it himself.

Drafting a letter to President Roosevelt

The suggestion to involve the Queen of Belgium never materialized and was replaced by this better idea. After contacting Sachs, Szilárd wrote a letter to Einstein, enclosing a draft of the letter Einstein was to write. Then he went to visit Einstein again in Peconic. Wigner was in California at the time; therefore, Szilárd was accompanied by another Hungarian-born physicist, Edward Teller—the future ‘father’ of the hydrogen bomb. Together they convinced Einstein to write President Roosevelt to encourage him to develop atomic weaponry research in the United States. Einstein dictated his own rough draft in German to Teller, who wrote it down and kept notes on it. Using the German text as a guide, Szilárd prepared an English version and also kept notes on it.³¹ The letter, dated 2 August, 1939, the day World War II began, was made official on 1 September, 1939, when the Nazis attacked Poland. The following letter was sent to President Roosevelt:

Sir:

Some recent work by E. Fermi and L. Szilárd, which has been communicated to me in manuscript, leads me to expect that the element uranium may be turned into a new and important source of energy in the immediate future. Certain aspects of the situation seem to call for watchfulness and, if necessary, quick action on the part of the administration. I believe, therefore, that it is my duty to bring to your attention the following facts and recommendations.

In the course of the last four months it has been made probable through the work of Joliot in France as well as Fermi and Szilárd in America that it may become possible to set up nuclear chain reactions in a large mass of uranium, by which vast amounts of power and large quantities of new

radium-like elements would be generated. Now it appears almost certain that this could be achieved in the immediate future.

This new phenomenon would also lead to the construction of bombs, and it is conceivable—though much less certain—extremely powerful bombs of a new type may thus be constructed. A single bomb of this type carried by boat or exploded in a port might very well destroy the whole port altogether with some surrounding territory. However, such bombs might very well prove to be too heavy for transportation by air.

The United States has only very poor ores of uranium in moderate quantities. There is some good ore in Canada and the former Czechoslovakia, while the most important source is in the Belgian Congo.

In view of this situation you may think it desirable to have some permanent contact maintained between the administration and the group of physicists working on chain reaction in America. One possible way of achieving this might be for you to entrust with this task a person who has your confidence and who could perhaps serve in an unofficial capacity. His task might comprise the following:

a) To approach government department, keep them informed of further developments, and put forward recommendations for government action, giving particular attention to the problem of securing a supply of uranium ore for the United States.

b) To speed up the experimental work which is at present being carried on within the limits of the budgets of the university laboratories, by providing funds, if such funds be required, through his contacts with private persons who are willing to make contributions for this cause, and perhaps also by obtaining the cooperation of industrial laboratories which have the necessary equipment.

I understand that Germany has actually stopped the sale of uranium from Czechoslovakian mines which she has taken over. That she should have taken such early

action might perhaps be understood on the ground that the son of the German Undersecretary of State, von Weizsacker, is attached to the Kaiser Wilhelm Institute in Berlin, where some of the American work on uranium is now being repeated.

Yours very truly,

A. Einstein³²

This letter proves that Einstein considered the threat of the bomb a more serious evil than that of war. Now it was necessary to select the person who would deliver the letter to the President. They considered investment banker Bernard Baruch, MIT President Karl Compton, and Charles Lindbergh as possible go-betweens.

An international hero is briefly considered

Speaking to Einstein about their need for a person of broader influence to carry the letter to Roosevelt, Szilárd suggested Charles Lindbergh. The aviator's successful solo flight across the Atlantic Ocean had made him an international celebrity overnight. Having met the famous pilot in New York some years earlier, Einstein wrote Lindbergh a note of introduction and included it with the signed letters—there were two versions, a short one and a longer one—which he gave to Szilárd. The note's substance was:

I would like to ask you to do me a favor of receiving my friend Dr Szilárd and think very carefully about what he will tell you. To one who is outside of science the matter he will bring up may seem fantastic. However, you will certainly become convinced that a possibility is presented here which has to be very carefully watched in the public interest.³³

Lindbergh did not respond to Einstein's note. In fact, his interests were antagonistic to those of Einstein, Szilárd and Teller. Just a year before, Lindbergh had received

Germany's Medal of Honour from the Nazi Hermann Goehring, and openly opposed Roosevelt's ideas. Not knowing these facts, they sent another letter on 13 September, soliciting Lindbergh's assistance. On 15 September, 1939, Lindbergh addressed the entire nation. In his speech, he made several ominous declarations, the least of which was that the United States should adopt a policy of isolation in the European conflict with Hitler. Far worse was his accusation that the Jews controlled events through their ownership of the media: 'We must ask who owns and influences the newspaper, the news picture, and the radio station,' he said. Far, far worse was his next statement: 'If our people know the truth [ie, that Jews are to blame for the war in Europe] our country is not likely to enter the war.'³⁴ In light of Lindbergh's speech, Sachs was chosen to give Einstein's signed letter to the President. For unknown reasons, he did not deliver it until 11 October, 1939, almost two months later, and three weeks after Nazi Germany had defeated Poland.³⁵

Roosevelt wrote to thank Einstein for his part and to tell him that he had dedicated \$6,000 for an Advisory Committee, whose purpose was 'to thoroughly investigate the possibilities of your suggestion regarding the element of uranium.'³⁶ Szilárd, Wigner and Teller were present to initiate the early efforts of the committee coordinated by Dr Lyman Briggs.³⁷

Szilárd deserves credit for alerting the United States to Nazi Germany's possible nuclear armament. Although Einstein was not fully aware of how the Nazis might be using uranium, Szilárd had decided to act on his own fear that Germany might want to use it to build an atomic bomb. As a refugee lacking official status, Szilárd could not bring his ideas to bear upon the White House, so he willingly accepted the fact that Einstein's influence would get his message to the President of the United States.

A matter of secrecy in a crucial year

The year 1939 was a crucial period in the impending second world conflict as well as in the critical efforts to build a nuclear bomb. By this time, Great Britain, and later that year Germany, had news of the latest nuclear developments. Sometime after October 1939, through his German refugee friends, Szilárd became aware of increased research on nuclear fission in Germany's science labs.³⁸ After Hitler invaded Prague that year, the Nazi threat was spreading across Europe and beyond.

On 30 October, 1939, Joliot-Curie recorded the principle of nuclear reactors in

a sealed envelope sent to the French Academy of Sciences and kept sealed until 1949.³⁹ By March 1940, the Advisory Committee had proved ineffectual. Szilárd was so concerned that he went to see Einstein in Princeton and asked him to send a second letter, which Einstein did on 7 March, 1940, co-writing it with Szilárd and addressing it to Sachs. This letter, which reached Roosevelt on 15 March, asked the President if the work was proceeding as rapidly as it should. This revived his interest in uranium research. The President called for a special conference to move the work forward 'with greater speed and on a larger scale.'⁴⁰

(To be continued)

NOTES

- 1 Albert Einstein, *Einstein on Humanism* (Carol Publishing Group, 1993), p. 51.
- 2 Banesh Hoffman and Helen Dukas, *Albert Einstein, Creator and Rebel* (The Viking Press, 1972), pp. 173-4. [Hereafter *Creator and Rebel*]
- 3 Ronald W. Clark, *Einstein, The Life and Times* (The World Publishing Company, 1971), p. 260. [Hereafter *Life and Times*]
- 4 *Creator and Rebel*, p. 179.
- 5 According to correspondent Sir William Dampier-Whetham. *Life and Times*, p. 545.
- 6 *Creator and Rebel*, p. 200.
- 7 Walter Isaacson, *Einstein, His Life and Universe* (Simon & Schuster, 2007), p. 272. [Hereafter *His Life and Universe*]
- 8 *Understanding Einstein*, p. 261.
- 9 Swami Tathagatananda, *Albert Einstein: His Human Side* (1993), p. 23.
- 10 *Creator and Rebel*, p. 201.
- 11 *Life and Times*, p. 539.
- 12 *Ibid.*
- 13 *Ibid.*, p. 546.
- 14 *Ibid.*
- 15 *Creator and Rebel*, p. 202.
- 16 *Ibid.*
- 17 *Ibid.*, p. 208.
- 18 *His Life and Universe*, p. 469.
- 19 *His Human Side*, p. 44.
- 20 *Life and Times*, p. 548.
- 21 *Ibid.*
- 22 *His Life and Universe*, p. 469.
- 23 *Life and Times*, p. 126.
- 24 *Ibid.*, p. 548.
- 25 *Creator and Rebel*, p. 202; see also *His Life and Universe*, p. 471.
- 26 *Life and Universe*, p. 472.
- 27 *Ibid.*
- 28 *Creator and Rebel*, p. 206.
- 29 *Ibid.*, p. 207.
- 30 *Life and Universe*, p. 468.
- 31 *Ibid.*, p. 473.
- 32 *Understanding Einstein*, pp. 285-6.
- 33 *His Life and Universe*, p. 475.
- 34 *Ibid.*
- 35 *Creator and Rebel*, p. 206.
- 36 *His Life and Universe*, p. 476.
- 37 *Ibid.*
- 38 *Ibid.*, p. 477.
- 39 *Encyclopedia Britannica*.
- 40 *His Life and Universe*, p. 477.

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